ENVS*4390 Soil Variability and Land Evaluation

Fall 2022
Section(s): 01

School of Environmental Sciences
Credit Weight: 1.00
Version 1.00 - August 31, 2022

1 Course Details

1.1 Calendar Description

This course integrates formal in-field (including a two-day camp & excursions during orientation week) and laboratory training, with classroom discussions of concepts, to guide independent group projects on the gathering and interpreting of soilscape information. The principal focus is on soil, as a spatially- and temporally-variable product and component of ecosystems; special consideration is given to the factors controlling soil processes, from local to global scales. An examination of methods, for describing and quantifying the distribution of soils, includes survey and sensor-based techniques, in conjunction with data trend analysis and modelling. Students are required to notify the instructor in the preceding Winter semester of their intention to participate.

Pre-Requisites: 15.00 credits including (1 of AGR*2320, ENVS*2060, ENVS*2310, ENVS*2340, SOIL*2010)
Restrictions: ENVS*3120, ENVS*4150, ENVS*4250, SOIL*4250

1.2 Course Description

This course integrates formal in-field (including a four-day camp & excursions during orientation week) and laboratory training, with classroom discussions of concepts, to guide independent group projects on the gathering and interpreting of soilscape information. The principal focus is on soil, as a spatially- and temporally-variable product and component of ecosystems; special consideration is given to the factors controlling soil processes, from local to global scales. An examination of methods, for describing and quantifying the distribution of soils, includes survey and sensor-based techniques, in conjunction with data trend analysis and modelling. Students are required to notify the instructor in the preceding Winter semester of their intention to participate.

1.3 Timetable
Lectures: TTh 10:00 am to 11:20 am, room ALEX 124

Labs (before Midterm Exam): M 10:30 am to 11:20 am, room ALEX 124

1.4 Final Exam

Scheduled by the Registrar’s Office - Wednesday, December 14, 2022, 08:30 am to 10:30 am; online.

2 Instructional Support

2.1 Instructional Support Team

Instructor: Richard Heck
Email: rheck@uoguelph.ca
Telephone: +1-519-824-4120 x52450
Office: ALEX 140
Office Hours: Appointments arranged by email

3 Learning Resources

3.1 Required Resources

Characterizing Sites, Soils & Substrates in Ontario (Other)
“Characterizing Sites, Soils & Substrates in Ontario Volume 1-Field Description Manual”
School of Environmental Sciences, University of Guelph.

Characterizing Sites, Soils & Substrates in Ontario (Lab Manual)
Copies of "Characterizing Sites, Soils & Substrates in Ontario Volume 2-Compendium of
Interpretive Frameworks" and "Munsell Soil Color Charts" will be provided for field
activities.

3.2 Recommended Resources

Soil: Morphology, Genesis and Classification (Textbook)

Soils: Genesis and Geomorphology (Textbook)
University Press.

Manual of Methods for Soil and Land Evaluation (Other)
Publishers.

The System of Soil Classification for Canada (Textbook)
4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:
1. Comprehend the techniques for in-field description of soils and their landscape setting
2. Recognize the major types of landforms and soils in SW Ontario, under both natural and managed ecosystems.
3. Understand principal controls on the distribution of soils and dynamics of the dominant processes occurring in them.
4. Be acquainted with both traditional and evolving approaches gathering, processing and interpreting soilscape information.
5. Use the Canadian System of Soil Classification and recognize the main international systems
6. Apply major national systems/frameworks to evaluate and rate land capability or suitability
7. Working within a group context, collect key characteristics of a focus landscape, then integrate/rationalize with existing land resource information and primary literature.

5 Teaching and Learning Activities

5.1 Lecture

Tue, Sep 13

Topics: 1 Soil & the Pedosphere

Evaluation: Midterm Exam

Thu, Sep 15

Topics: 2.1 Natural Controls on Soil Variability - Site Factors

Evaluation: Midterm Exam

Tue, Sep 20
Topics: 2.2 Natural Controls on Soil Variability - Flux Factors
Evaluation: Midterm Exam
Thu, Sep 22

Topics: 3.1 Soilscape Inventory - Traditional Soil Survey & Mapping
Evaluation: Midterm Exam
Tue, Sep 27

Topics: 3.2 Soilscape Inventory - Application of Remote Sensing
Evaluation: Midterm Exam
Thu, Sep 29

Topics: 3.3 Soilscape Inventory - Application of Proximal Sensing Techniques
Evaluation: Midterm Exam
Tue, Oct 4

Topics: 4.1 Land Evaluation Systems - Canada Land Inventory
Evaluation: Midterm Exam
Thu, Oct 6

Topics: 4.2 Land Evaluation Systems - Ecological & Agri-Environmental Systems
Evaluation: Midterm Exam
Thu, Oct 13

Topics: 4.3 Land Evaluation Systems - Land Suitability Rating Systems
Evaluation: Midterm Exam
Tue, Oct 18

Topics: 5.1 Quantifying Soilscape Variability - Conventional Statistics & Geostatistics
Evaluation: Midterm Exam
Thu, Oct 20

Topics: 5.2 Quantifying Soilscape Variability - Modelling the Soil Continuum

Evaluation: Midterm Exam

Tue, Oct 25

Topics: 6.1 Soil Development - Gains & Losses

Evaluation: Final Exam

Tue, Nov 1

Topics: 6.2 Soil Development - Translocations & Transformations

Evaluation: Final Exam

Thu, Nov 3

Topics: 6.3 Soil Development - Soil Morphogenesis

Evaluation: Final Exam

Tue, Nov 8

Topics: 6.4 Soil Development - Soil Through Time

Evaluation: Final Exam

Thu, Nov 10

Topics: 7.1 Soil Quality - Human Impact on Soil

Evaluation: Final Exam

Tue, Nov 15

Topics: 7.2 Soil Quality - Indicators

Evaluation: Final Exam

Thu, Nov 17

Topics: 8.1 Soil Classification - Basic Concepts

Evaluation: Final Exam

Tue, Nov 22
8.2 Soil Classification - Wetland Soils
Evaluation: Final Exam
Thu, Nov 24

8.3 Soil Classification - Woodland Soils
Evaluation: Final Exam
Tue, Nov 29

8.4 Soil Classification - Grassland Soils
Evaluation: Final Exam
Thu, Dec 1

8.5 Soil Classification - Other Soils
Evaluation: Final Exam

5.2 Lab

Mon, Sep 12
Due Date: same day (12 Sep 2022)
Grade: 1%

Mon, Sep 19
Topics: Digital Elevation Models in Soilscape Evaluation - accessing digital elevation models & landform segmentation
Due Date: one week later (26 Sep 2022)
Grade: 1%

Mon, Sep 26
Topics: Geological & Ecological Inventory Resources for Soilscape Evaluation - accessing & interpreting geological and ecological spatial data and reports
Due Date: one week later (03 Oct 2022)
Grade: 1%
**Mon, Oct 3**

**Topics:** Soil Inventory Resources for Soilscape Evaluation - accessing & interpreting soil spatial data and reports.

Due Date: TWO weeks later (17 Oct 2022), due to Thanksgiving Holiday Break

Grade: 1%

**Mon, Oct 17**

**Topics:** Land Capability Inventories for Soilscape Evaluation - accessing & interpreting land capability data and reports

Due Date: one week later (24 Oct 2022)

Grade: 1%

### 5.3 Field Trips

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Due Date</th>
<th>Grade</th>
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<tbody>
<tr>
<td>Sep 6</td>
<td>Field Camp/Excursion – University of Guelph Arboretum &amp; Hand Texturing</td>
<td>same day</td>
<td>4%</td>
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<tr>
<td>Sep 7</td>
<td>Field Camp/Excursion – Guelph Drumlín Field (UofG Elora Research Station)</td>
<td>same day</td>
<td>5%</td>
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<tr>
<td>Sep 8</td>
<td>Field Camp/Excursion – Paris Moraine &amp; Outwash Plain (UofG Arboretum Nature Reserve, Starkey Conservation Area/Arkell Springs), Blackbridge Road/Speed River, &amp; Luther Marsh Wildlife Management Area (to be confirmed)</td>
<td>same day</td>
<td>3%</td>
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<tr>
<td>Sep 9</td>
<td>Field Camp/Excursion – Flamborough Plain (Kirkwall area), Haldimand Clay Plain (Cayuga area), Norfolk Sand Plain (UofG Simcoe Research Station)</td>
<td>same day</td>
<td>3%</td>
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<tr>
<td>Sep 12 to 26</td>
<td>Independent Group Project – reconnaissance of study area sub-region (required for Group Project Plan)</td>
<td>Sept 26</td>
<td>5%</td>
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<tr>
<td>Oct</td>
<td>Independent Group Project - in-field survey of study area sub-</td>
<td>Oct 10%</td>
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01 to Oct 24 region (required for Preliminary Technical Report)

5.4 Field Trip Equipment and Transportation
*Equipment (including reflective vests and safety supplies) and transportation (rental vehicles) will be provided for the Field/Camp Excursions. Equipment will be provided for Group Projects, but students are responsible for their own transportation.

5.5 Additional Costs
Students must use appropriate clothing for field work, including protective footwear. Students will also need to bring their own lunches, each day, during the Field Camp/Excursions.

6 Assessments

6.1 Marking Schemes & Distributions

<table>
<thead>
<tr>
<th>Name</th>
<th>Scheme A (%)</th>
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<tbody>
<tr>
<td>Field Camp &amp; Excursion Exercises/Notes</td>
<td>15</td>
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<tr>
<td>Laboratory Exercises</td>
<td>5</td>
</tr>
<tr>
<td>Group Project Plan</td>
<td>5</td>
</tr>
<tr>
<td>Midterm Examination - sections 1 to 5</td>
<td>22.5</td>
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<tr>
<td>Project Preliminary Technical Report</td>
<td>10</td>
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<tr>
<td>Project Final Technical Report</td>
<td>10</td>
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<tr>
<td>Group Project Oral Presentation</td>
<td>10</td>
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<tr>
<td>Final Examination - sections 6 to 8</td>
<td>22.5</td>
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<td>Total</td>
<td>100</td>
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6.2 Assessment Details

**Field Camp & Excursion Exercises/Notes (15%)**
*Due: Tue, Sep 6 - Fri, Sep 9*

**Laboratory Exercises (5%)**
*Due Date: On the same day as lab or one week later, as per specific instructions.*

**Group Project Plan (5%)**
*Due: Mon, Sep 26*

**Midterm Examination (22.5%)**
Due: Thu, Oct 27, classroom  
Exam covers sections 1 to 5, inclusive.

**Project Preliminary Technical Report (10%)**  
**Due:** Mon, Oct 24

**Project Final Technical Report (10%)**  
**Due:** Mon, Nov 14

**Group Project Oral Presentation (10%)**  
**Due:** Mon, Nov 28 - Fri, Dec 2  
Specific date & time to be collectively determined

**Final Examination (scheduled by registrar) (22.5%)**  
**Date:** Wed, Dec 14, 8:30 AM - 10:30 AM, to be set by Registrar’s Office  
Date and time set by Registrar’s Office. Exam covers sections 6 to 8, inclusive.

6.3 Additional Notes (if required):

6.4 Additional Course Information

**Independent Group Project Technical Reports & Presentation**

*(Instructions and Guidelines)*

Overview - this group exercise constitutes 35% of the final course grade:

Each group of 3 or 4 students will research relevant literature, acquire available biophysical resource inventories (including, but not restricted to, soils, geology, physiography and ecology) for an assigned sub-region of a study area to be determined (within or near Guelph), as well as conduct in-field surveys (including, but not limited to, soil and vegetation). This information is to be collated, synthesized and interpreted. Special guidance, with respect to aspects to be considered, will be provided once study area has been confirmed.

A) Group Project Plan (5% final grade) – due Sep 26’22, feedback same week:

Structure: cover page; table of contents; goals & objectives; identification of study area sub-region (imagery/maps); existing biophysical resource inventories and type of literature to be reviewed; in-field survey activities to be conducted, with methods and resources/equipment to be used; timeline for project development (considering reports and presentation); distribution of tasks among group members; reference cited.

Formatting: 4 pages (including cover page and table of contents); font size 12 Times New Roman (for graphics use sans serif); 1.5 line spacing; 1” margins, justified on both left and right sides; sequentially-numbered section headings/subheadings, sequentially-numbered tables and graphics, and pages to be numbered; all tables and graphs must have appropriate
titles. Must use referencing style of ‘Canadian Journal of Soil Science - CJSS’.

Evaluation (by instructor) Criteria: presentation, organization, content, synthesis, writing style. Rubric to be provided at start of class.

B) Project Preliminary Technical Report (10% final grade) – due Oct 24’22, feedback same week:

Structure: cover page; table of contents; list of tables; list of figures; introduction, with goals & objectives; relevant excerpts of existing biophysical resource inventories; type of literature encountered; description of in-field survey activities, with methods and resources/resources used; presentation (summary tables or graphics) of results of in-field survey; strategy for interpretation of material; references cited; appendices.

Formatting: minimum 8 to maximum 10 pages (NOT including cover page, tables of contents, list of tables, list of figures, reference citation list and appendices); font size 12 Times New Roman (for graphics use sans serif); 1.5 line spacing; 1” margins, justified on both left and right sides; sequentially-numbered section headings/subheadings, sequentially-numbered tables and graphics, and pages to be numbered; all tables and graphs must have appropriate titles. Summary tables and graphs to be inserted in report body; other materials (including field forms/notes, as well as any previous feedback from instructor) go in appendices. Must use referencing style of ‘Canadian Journal of Soil Science - CJSS’.

Evaluation (by instructor) Criteria: presentation, organization, content, synthesis and writing style. Rubric to be provided at start of class.

C) Project Final Technical Report (10% final grade) – due Nov 14’22, feedback same week:

Structure: cover page; table of contents; list of tables; list of figures; introduction, with goals & objectives; review of literature; characterization of study area sub-region, using relevant excerpts of existing biophysical resource inventories; description of in-field survey activities, with methods and resources/resources used; results of in-field survey & discussion; summary and conclusions; references cited; appendices.

Formatting: minimum 10 to maximum 12 pages (NOT including cover page, tables of contents, list of tables, list of figures, reference citation list and appendices); font size 12 Times New Roman (for graphics use sans serif); 1.5 line spacing; 1” margins, justified on both left and right sides; sequentially-numbered section headings/subheadings, sequentially-numbered tables and graphics, and pages to be numbered; all tables and graphs must have appropriate titles. Summary tables and graphs to be inserted in report body; other materials (including any previous feedback from instructor) go in Appendix. Must use referencing style of ‘Canadian Journal of Soil Science - CJSS’.

Evaluation (by instructor) Criteria: presentation, organization, content, synthesis and writing style. Rubric to be provided at start of class.
D) Group Oral Presentation (10% of final grade) – Nov 28 to Dec 02’22 (location & time TBD):

Time Slot: 20 minutes per group - 15 minutes for presentation, 5 minutes for possible discussion.

Format: computer (with PowerPoint) and projector will be available.

Evaluation (by instructors and students – all students must attend other presentations)
Criteria: suitability/quality of AV aids, organization, presentation style, content and audience engagement. Students who do not submit the evaluation forms, will lose 1 point off their final grade. Rubric to be provided at start of class.

7 Course Statements

7.1 Grading Policies:

10% reduction of grade (evaluated), for item in question, for each week or part thereof. Items not received before the date set for start of final exams, will be assigned a grade of 0 (zero).

7.2 Course Policy on Group Work:
Field Camp/Excursion forms to be completed and submitted as groups of 3 or 4. General notes from Field Camp/Excursions to be completed and submitted individually. Laboratory assignments to be completed and submitted individually. Group Project components to be completed and submitted as groups of 3 or 4.

7.3 Course Policy regarding use of electronic devices and recording of lectures:
Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

8 University Statements
8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared
responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student,
or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.